OL. 5 No. 7 July, 1961

COMPUTER ABSTRACTS

Editor: B. A. Fancourt, B.Sc.

Published by Technical Information Company, Ltd., Chancery House, Chancery Lane, London, W.C.2.

CONTENTS

ENERAL 1
ESIGN.. 2
EARNING AND PATTERN RECOGNITION .. 2
ATHEMATICS 3
ECHNIQUES 3
CCESSORIES 5
LEMENTS 6
NALOGUE 7
IGITAL 7
ROGRAMMING 7
APPLICATIONS
Aeronautical 8
Business 9
Chemical 9
Control—Production and Process 9
Electronics 10
Engineering, Civil 10
Engineering, Electrical 10
Engineering, Mechanical 10
Information Retrieval 10
Mechanical Translation 10
Medical 10
Military 11
Nuclear 11
Physics 11
Simulation 11
Transport 12
Miscellaneous 12
BOOKS 12
AUTHOR INDEX 13
PATENT INDEX 14

GENERAL

1378 **The Achilles heel of data processing.** A. G. Barclay, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 69-82. In this paper it is suggested that the Achilles heel of electronic data processing lies in the field of maintaining and revising systems (N.B.—'System' as used here does not include physical equipment). The position of the Systems Maintenance and Programming Revisions group in the E.D.P. organisation at the Hydro-Electric Power Commission of Ontario is explained. Problem areas of the group in connection with matters such as documentation of the system, program documentation and system design are discussed.

1379 **A card format for reference files in information processing.** M. Grems, *Commun. ACM*, **4**, Feb. 1961, 90-98. This paper proposes a card format suitable for a variety of files dealing with the subject of information processing. The card format can be used for reference files of books, articles, programming terms, hardware terms, equipment, machine systems, abbreviations, etc. The format is flexible enough to permit the recording of as much reference material as may be required in any particular case and at the same time is rigid enough to permit the merging of different files and to provide the identification needed for sorting, selecting, ordering, etc., the reference material in a variety of ways. The file can be searched by hand, by punched card equipment or transferred to tape for searching by data processing equipment. The flexible arrangement of the (written) reference material and the rigid arrangement of the (punched) identification is achieved by dividing an 80-column IBM card into a reference field (columns 1-67) and an identification field (columns 68-80). Each entry in a file consists of an index card together with such further cards as may be required. The reference field of the index card contains such material as a name (e.g. of an author or system), a term or an abbreviation. Also in this reference field is punched identification material in the form of a coded matrix of descriptors occupying columns 40 to 67. The further cards are used for such matters as title, source (e.g. page number, machine name), class (descriptors or field of interest), summary, cross reference. In the identification field of each card codes are punched for entry number, card number (within the entry), continuation card number, kind of reference, major interest of reference, and source of reference. 3 refs.

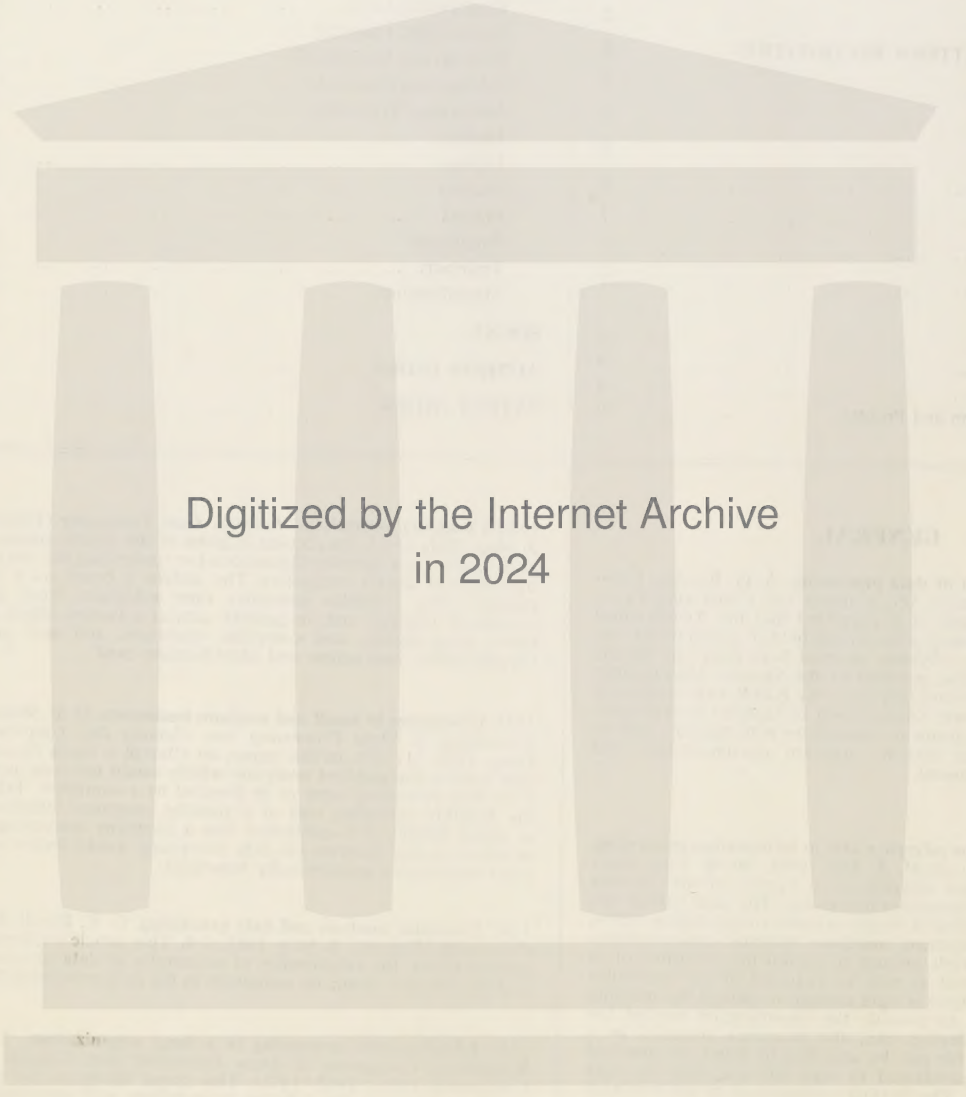
1380 **Computer control.** E. Webster, *Data Processing (Detroit)*, **3**, May 1961, 29-33. An account is given of the system employed at Sylvania Data Systems Operations for controlling the use and operation of digital computers. The system is based on a 'dispatcher' who compiles computer time schedules from programmers' requests and, in general, acts as a liaison officer between programmers and computer operators, and also on a keypunchable 'instruction and identification card'.

1381 **Computers in small and medium businesses.** D. B. Watson, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 311-320. In this paper, an attempt is made to ascertain what is the smallest company which would not lose money if its data processing were to be handled by a computer. Taking the monthly operating cost of a suitable computer installation as about $6,000, it is concluded that a company employing 23 or more clerical workers on data processing would find a computer installation economically beneficial.

1382 **Economic analysis and data processing.** G. E. Bissell, *Data Processing (Detroit)*, **3**, May 1961, 7-9. This article explores in general terms, the relationship of economics to data processing and the role of a company economist in the data processing field.

1383 **Effective data processing in a large organization.** E. D. Kingsbury, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 13-23. This paper discusses the experience of Imperial Oil Limited in installing and operating an IBM 705 Model II system as a centralised service facility for various data processing tasks.

1384 **The gap in programming support.** R. L. Patrick, *Datamation*, **7**, May 1961, 37. The author expresses concern regarding the difficulties of maintaining digital computers and suggests that the problem of diagnosing faults might be solved by combining pattern recognition techniques and computer techniques for designing computers. It might be possible to develop a program which when given the symptoms of a failure and the final results of the happening could look for failure patterns and indicate possible hardware conditions which could have caused the error to take place.



Digitized by the Internet Archive
in 2024

https://archive.org/details/computer-abstracts_1961-07_5_7

1385 **On the nature of scientific evidence.** D. B. DeLury, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 93-97. This paper seeks to demonstrate the importance of *random* selection of observations from a (statistical) population in order to ensure that they faithfully represent the frequency distribution of the population. As an example, the studies that have led to the allegation that smoking causes cancer of the lung are examined. 1 ref.

1386 **Operations research and management.** B. A. Wilson, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 98-108. This paper examines the problems of management in making use of the techniques of operations research by discussing the answers to the questions: What can I expect from these new techniques? What can the practitioners of the techniques expect of me? What will the effects be on my job and my organisation? How can I keep control of such activity if I am not myself a specialist in the field?

1387 **Symbolic analysis methods for information systems.** N. Chapin, *Commun. ACM*, **4,** Feb. 1961, 114. Brief summary of research at Stanford Research Institute in the area of information systems and having the purposes of producing new techniques of systems analysis and systems design that will be free of many of the defects of present techniques and of programming a general purpose computer to enable it to apply at least major parts of these new techniques, in a way that will enable a linkage with automatic coding techniques. 3 refs.

1388 **Technometrics and education.** A. Porter, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 1-12. This paper constituted the keynote address to the Second Conference of the Computing and Data Processing Society of Canada, 6-7th June 1960. Technometrics is used in the sense of 'the purposeful treatment of numerical data', i.e. data processing, and the paper considers both the impact of technometrics on education and education in technometrics. Topics which are discussed include information theory and operations research in the communication of symbols and ideas; the learning process, pattern recognition and goal-seeking; and the feedback principle. In conclusion, three specific areas in which appreciable advances may be expected are noted: university courses in technometrics; data processing in government at all levels; and medical statistics. 8 refs.

1389 **Electronic data processing machine requirements.** R. G. Canning, California University, Los Angeles, *PB 154422*, 31 July 1953, 31 p. 11 refs.

DESIGN

1390 **Checking circuit.** K. M. Trampel, *IBM Technical Disclosure Bull.*, **3,** May 1961, 24-25. Description of a 2 out of 5 validity checking circuit which samples the 5 input bits and provides an up output when two, and only two, of the input bits are down.

1391 **Design trends for large computer systems.** C. W. Adams, *Datamation*, **7,** May 1961, 20-22. This article reviews developments, in use or being planned, in the hardware and, more particularly, the logical design of large digital computers. Topics discussed include non-erasable or read-only storage, high-speed storage devices, arithmetic, address logic, instruction format and order codes, autonomous operation and modularity.

1392 **Hydraulic logic: What's its potential?** H. H. Glaettli, *Control Engng.*, **8,** May 1961, 83-86. This article describes the operation of basic hydraulic logic elements and their combination to form an exclusive OR circuit, a multivibrator, a shift register, a binary counter and a matrix. The basic differences between hydraulic logic and analogous electrical circuits are outlined and the questions of how small the hydraulic units can be and how their size affects speed are discussed. Calculations are presented to show that hydraulic logic elements are comparable to conventional relays in operating speed and power requirements.

1393 **NOR addition.** E. P. Crozier, *Instr. & Control Systems*, **34,** May 1961, 864-865. This article briefly presents the design by symbolic logic of an adder employing eight NOR elements.

1394 **Self-replacement circuit for cryogenic systems.** J. D. Rutledge, *IBM Technical Disclosure Bull.*, **3,** May 1961, 38-39. A description is given of a system comprising an operating cryogenic circuit together with a number of identical spare circuits. Upon a failure occurring in the operating circuit, power is removed from it and is automatically applied to the succeeding spare circuit. This then becomes the operating circuit. Such switching action automatically continues until a failure occurs in the last spare circuit, at which time an alarm device is actuated.

1395 **A stored logic computer.** H. M. Semarne and R. E. Porter, *Datamation*, **7,** May 1961, 33-36. This article explains the concept of stored logic which allows the instantaneous logical organisation of the computer to be specified as part of the program. The logic for any instructions above the micro-command level is stored in the computer memory in the form of a micro-program (i.e. a sequence of micro-commands). Any type of instruction can be made up out of micro-commands and stored in the memory as a macro-instruction. An account is given of the Ramo-Wooldridge AN/UYK-1, a solid state, parallel binary computer with stored logic characteristics and capabilities. Almost any desired stored logic configuration can be set up by means of logands which are elementary logic commands formed from small clusters of micro-commands.

1396 **Test method for multi-turn core windings.** M. A. Sanborn, *IBM Technical Disclosure Bull.*, **3,** May 1961, 34-35. Description of an arrangement for testing the number of turns in a particular winding of a square hysteresis loop core of assumed acceptable quality and having other windings of known numbers of turns. The apparatus is particularly useful in testing cores which have been assembled into a matrix where the core windings are interconnected in a particular manner. The test is effected by a pulse generating apparatus under the directive control of programming apparatus.

1397 **Determination of R_{cutoff} for asymmetric channel.** B Reiffen, M.I.T., *PB 153108*, 24 Oct. 1960, 18 p. Previously the author defined a computation cutoff rate, R_{cutoff}, for a discrete memoryless channel symmetric at its output with equally likely inputs. For information rates $R < R_{cutoff}$, sequential decoding may proceed with an average number of decoding computations which does not grow exponentially with constraint length. In this report, R_{cutoff} is defined for the general non-degenerate discrete memoryless channel with arbitrary input probabilities.

1398 **Realization of Boolean polynomials based on incidence matrices.** S. Okada, Y. Moriwaki and K. P. Young, Polytechnic Institute of Brooklyn, *PB 153234*, 16 Nov. 1959, 37 p. An algebraic method for finding minimum switching two-terminal networks for any given Boolean polynomial is established by adopting node-branch incidence matrices as unknown quantities. 41 refs.

1399 **Translating or swiching matrices.** Computer Developments Ltd., *B.P. 868551*, 17 May 1961. This patent is concerned with a matrix for selectively interconnecting two groups of wires, which is particularly suitable for use with transistor circuitry. The need for wiring diodes at cross-points is eliminated by providing a layer of non-linear conductive material common to all the cross-points.

1400 **Memory control in data processing system.** Int. Business Machines Corp., *U.S.P. 2968027*, 10 Jan. 1961. This patent describes control arrangements in a data processing system which facilitate the transfer of data into or out of non-sequential locations of memory.

1401 **Magnetic core circuitry.** Burroughs Corp., *U.S.P. 2968796*, 17 Jan. 1961. This patent is concerned with circuit arrangements for transferring data from one magnetic core to another.

1402 **Cryotron logic.** R. K. Richards, *U.S.P. 2969469*, 24 Jan. 1961. A basic cryotron logic circuit and its adaptation to provide a wide variety of logic functions are described.

1403 **Magnetic core circuitry.** Int. Business Machines Corp., *U.S.P. 2970297*, 31 Jan. 1961. A magnetic core branching circuit which does not require diodes is described.

LEARNING AND PATTERN RECOGNITION

1404 **Character recognition systems.** W. M. Lower and J. D. Buck, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 346-355. This paper briefly reviews character recognition and describes some of the equipment now in use. Magnetic ink, optical and handwriting systems are covered.

1405 **A complex information processing system for the LGP-30.** R. B. Banerji, *Computing & Data Processing Soc. Canada 2nd Conference Proc.,* 1960, 121-137. This paper is concerned with efforts at the University of New Brunswick to develop a system of subroutines for the LGP-30 so as to make available some of the salient features of the language known as IPL (Information Processing Language). After discussing the mechanics of the formation of a list structure, the LGP-30 subroutines which carry out operations on the list structure are described in some detail. Finally, a program is described which is believed to carry out operations involved in object recognition by human beings. 2 refs.

1406 **Synthex.** R. F. Simmons, *Commun. ACM,* **4,** March 1961, 140-141. Brief summary of a project of System Development Corporation with the object of developing a research methodology and a vehicle for the design and construction of a general purpose computerised system for synthesising complex human cognitive functions. The initial vehicle, proto-synthex, is to be an elementary language-processing device which reads simple printed material and answers simple questions phrased in elementary English. 3 refs.

1407 **General switching theory.** S. Litwin, R. McNaughton and R. L. Wexelblat, University of Pennsylvania, *PB 171555,* 15 Sept. 1960, 67 p. Atfer summarising the entire effort, detailed reviews of the GO program and the work on languages of symbolic logic are given. The RENJYU program is described in detail and a natural-language learning model is described. 30 refs.

1408 **A strategic pattern recognition program for the game GO.** D. Lefkovitz, University of Pennsylvania, *PB 171549,* 1 July 1960, 97 p. A set of "primitive" routines are defined for characterisation of patterns on the GO board. Strategic patterns are listed in a "Catalogue by primitive classes" and organised into a tree structure. 1 ref.

1409 **Symbolic logic and automata.** R. McNaughton, University of Pennsylvania, *PB 171548,* July 1960, 36 p. This report presents certain languages of symbolic logic for the description of the behaviour of finite automata. It describes precisely the conditions under which a formula of these languages describes the behaviour of an automaton, and presents a synthesis algorithm which constructs a state graph for an automaton given a formula that describes the automaton. It closes by listing some unsolved problems about these languages. 10 refs.

See also :—
Programming, Ref. 1505.

MATHEMATICS

1410 **Faktorenzerlegung Mersennescher Zahlen mittels programmgesteuerter Rechengeräte.** (Factorisation of Mersenne numbers by means of stored program computers.) E. Karst, *Numerische Mathematik,* **3,** 7 Feb. 1961, 79-86. (In German.) This paper reviews work on the factorisation of Mersenne numbers with digital computers. 14 refs.

1411 **Fehlerabschätzung mit Rechenanlagen bei gewöhnlichen Differentialgleichungen erster Ordnung.** (Error estimation with computer in the case of first-order ordinary differential equations.) J. Schröder, *Numerische Mathematik,* **3,** 7 Feb. 1961, 39-61. (In German.) This paper describes a method for error estimation in the numerical solution of first-order ordinary differential equations and its application on the IBM 650. 20 refs.

1412 **Fehlerfortpflanzung bei Interpolation** (Error propogation with interpolation). A. Schönhage, *Numerische Mathematik,* **3,** 7 Feb. 1961, 62-71. (In German.)

1413 **Das inhomogene natürliche Randwertproblem und Fehlerabschätzungen für Näherungslösungen.** (The heterogeneous real boundary value problem and error estimations for approximate solutions.) N. J. Lehmann, *Numerische Mathemtatik,* **3,** 7 Feb. 1961, 1-29. (In German.) 6 refs.

1414 **Some elementary remarks on polynomial approximations.** W. Fraser, *Computing & Data Processing Soc. Canada 2nd Conference Proc.,* 1960, 250-256. A brief introduction to the theory of approximations with reference to digital computers. 9 refs.

1415 **Ein Verfahren zur Berechnung des charakteristischen Exponenten der Mathieuschen Differentialgleichung. I.** (A method of computing the characteristic powers of Mathieu's differential equation. I.) F. W. Schäfke, *Numerische Mathematik,* **3,** 7 Feb. 1961, 30-38. (In German.)

1416 **An algorithm for finding rational approximations.** H. F. Mattson, Air Force Cambridge Research Labs., Bedford, Mass., *PB 153806,* Sept. 1960, 22 p. This report considers the question of how to find rational approximations to given functions. It includes definitions of terms, a precise statement of what the criterion of best fit is, and statements of some classical results. Two closely related iterative methods for finding best rational approximations are defined. A proof of convergence of these methods is given for a special case (in which both methods are the same) and these methods are compared with some others. Some results obtained by one of the methods are presented, together with a brief description of a computer program used to obtain them. 6 refs.

TECHNIQUES

1417 **Algorithms.** *Commun. ACM,* **4,** Feb. 1961, 105-106. Consists of the following algorithms (in ALGOL 60), certifications (of successful use of previously published algorithms) and remark :—

a. **Certification of Algorithm 13: Complex exponential integral.** P. J. Rader and H. C. Thacher, p. 105. Details of use on the LGP-30 of the algorithm published in *ibid,* **3,** July 1960, 406 (*C.A.,* **4,** Sept. 1960, Ref. 1681).

b. **Remark on Algorithm 20: Real exponential integral.** S. Peavy, p. 105. Correction of a printing error in the algorithm published in *ibid,* **3,** Oct. 1960, 540 (*C.A.,* **5,** Jan. 1961, Ref. 62).

c. **Certification of Algorithm 3: Solution of polynomial equations by Bairstow Hitchcock method.** J. S. Vandergraft, p. 105. Details of use on the Burroughs 220 of the algorithm published in *ibid,* **3,** Feb. 1960, 74-75 (*C.A.,* **4,** June 1960, Ref. 822).

d. **Algorithm 31: Gamma function.** R. M. Collinge, p. 105.

e. **Algorithm 32: MULTINT.** R. D. Freeman, p. 106. Performs a single, double, triple, . . . , T-order integration depending on whether n=1, 2, . . . T.

f. **Algorithm 33: Factorial.** M. F. Lipp, p. 106. This procedure makes use of the implicity defined recursive property of Algol to compute n!

g. **Algorithm 34: Gamma function.** M. F. Lipp, p. 106. This procedure generalises the recursive factorial routine, finding $\Gamma(1+x)$ for reasonable values of x.

1418 **Algorithms.** *Commun. ACM,* **4,** March 1961, 151-154. Consists of the following algorithms (in ALGOL 60), certification (of successful use of previously published algorithm) and remarks :—

a. **Algorithm 35: Sieve.** T. C. Wood, p. 151. Uses the Sieve of Eratosthenes to find all prime numbers not greater than a stated integer and stores them in an array.

b. **Algorithm 36: Tchebycheff.** A. J. Gianni, p. 151. Given a set of m+1 values of x stored in a one-dimensional array whose subscripts run from 0 to m at least, constructs a table of $t_n(x)$, n=0, 1, . . . , *l* and stores it in the two-dimensional array t, where you find $t_n(x[m])$ as t[n,m].

c. **Algorithm 37: Telescope 1.** K. A. Brons, p. 151. Takes an Nth degree polynomial approximation $\sum_{k=0}^{N} c_k x^k$ to a function which was valid to within eps ≥ 0 over an interval (0,L) and reduces it, if possible, to a polynomial of lower degree, valid to within limit > 0.

d. **Algorithm 38: Telescope 2.** K. A. Brons, p. 151-152. Takes an Nth degree polynomial approximation $\sum_{k=0}^{N} c_k x^k$ to a function which was valid to within eps ≥ 0 over an interval (−L, L)and reduces it, if possible, to a polynomial of lower degree, valid to within limit >0.

e. **Algorithm 39: Correlation coefficients with matrix multiplication.** P. Sassouni, p. 152. Given an observation matrix [x] consisting of observations x_{ij} on a population, calculates

$$y_{ij} = \frac{x_{ij} - \bar{x}_j}{\sqrt{\sum_{i=1}^{m} (x_{ij} - \bar{x}_j)^2}} \quad \begin{matrix} \text{for } i = 1, \ldots, m \\ j = 1, \ldots, n \end{matrix}$$

and the standard deviations

$$s_j = \sqrt{\frac{\sum_{i=1}^{m} (x_{ij} - \bar{x}_j)^2}{m}}$$

where $\bar{x}_j$ is the mean of observations on the j-th factor. This completes normalisation and the correlation matrix is computed by a further procedure which multiplies two matrices, the first being the transpose of the second.

f. **Algorithm 40: Critical path scheduling.** B. Leavenworth, p. 152-153. Given the total number of jobs n of a project, the vector pair I_k, J_k representing the kth job, which is thought of as an arrow connecting event I_k to event J_k ($I_k < J_k$, k=1, . . . , n), and a duration vector $(DIJ)_k$, this procedure determines the earliest starting time, latest starting time, earliest completion time, latest completion time, the total float, and the free float. 2 refs.

g. **Remarks on Algorithms 2, 3, 15, 25 and 26.** J. H. Wilkinson, p. 153. Refers to algorithms published in *ibid,* **3,** Feb. 1960, 74-75; Aug. 1960, 475; Nov. 1960, 602-603 (*C.A.,* **4,** June 1960, Ref. 822; Oct. 1960, Ref. 1927; **5,** Feb. 1961, Ref. 257). Remarks are made, giving examples of use on ACE, as to the accuracy of the procedures. 1 ref.

h. **Certification of Algorithm 4: Bisection routine.** P. J. Rader, p. 153-154. Details of use on the LGP-30 of the algorithm published in *ibid,* **3,** March 1960, 174 (*C.A.,* **4,** June 1960, Ref. 822).

i. **Remark on Algorithm 16: Crout with pivoting.** H. C. Thacher, p. 154. Corrections are given for the algorithm published in *ibid,* **3,** Sept. 1960, 507-508 (*C.A.,* **4,** Nov. 1960, Ref. 2119).

j. **Remark on Algorithm 25: Real zeros of an arbitrary function.** R. M. Collinge, p. 154. Corrections to the algorithm published in *ibid,* **3,** Nov. 1960, 602 (*C.A.,* **5,** Feb. 1961, Ref. 257).

1419 **The analysis of power spectra.** N. Shklov and J. H. Toop, *Computing & Data Processing Soc. Canada 2nd Conference Proc.,* 1960, 243-249. This paper considers the method of power spectrum analysis of stationary time series, briefly describes an LGP-30 program and mentions various applications. 4 refs.

1420 **Automatic machine scheduling.** J. C. Hammerton, *Computers & Automn.,* **10,** May 1961, 17-22. This article explores the need for a computer to schedule its own operations and produce working instructions to implement the schedules. Methods classified as 'prediction', 'one-ahead' and 'demand' scheduling are discussed. The effect of automatic machine scheduling on computer design is considered.

1421 **Bitwise operations.** C. Strachey, *Commun. ACM,* **4,** March 1961, 146. This note is concerned with the design of efficient processes for bitwise operations such as counting the ones or reversing the digits of a binary word, efficient being taken to mean a process in which both the space occupied and the time taken are functions which increase only approximately logarithmically with the number of bits in the word. It is shown how such an efficient process may be devised for reversing the bits in a word.

1422 **Comment on a paper on parallel processing.** M. R. Nekora, *Commun. ACM,* **4,** Feb. 1961, 103. Brief comments on 'Some thoughts on parallel processing', L. D. Yarborough, *ibid,* **3,** Oct. 1960, 539 (*C.A.,* **5,** Jan. 1961, Ref. 70).

1423 **Comparison of iterative methods for the calculation of *n*th roots.** J. F. Traub, *Commun. ACM,* **4,** March 1961, 143-145. In this paper, three iterative methods for calculating *n*th roots are compared. The methods are Newton's method, Bailey's method and a method, called multiterm iteration, proposed by the author and which is a generalisation of Newton's method. The methods are compared in two ways: theoretical convergence estimates are given; and machine running time is estimated by means of a macro compiler which counts the number of machine cycles in any segment of a program. 4 refs.

1424 **Data sorting with digital computers.** J. W. Graham, *Computing & Data Processing Soc. Canada 2nd Conference Proc.,* 1960, 211-225. This paper discusses with the aid of examples some of the techniques for sorting data using a digital computer with magnetic tapes. Topics dealt with include: symmetrical merge; optimising the number of records to be sorted internally; non-symmetrical merge; digital sorting; distribution sorting; internal sorting; summarizing sorting; generalised sorting. 2 refs.

1425 **Erratum.** *Commun. ACM,* **4,** Feb. 1961, 98. Errors in formulae in 'On programming the numerical solution of polynomial equations', K. W. Ellenburger, *ibid,* **3,** Dec. 1960, 644-647 (*C.A.,* **5,** Feb. 1961, Ref. 271) are pointed out by the author.

1426 **A generalized technique for symbol manipulation and numerical calculation.** D. T. Ross, *Commun. ACM,* **4,** March 1961, 147-150. This paper is concerned with the large class of problems in which both symbol manipulation and numerical calculation are required and are inextricably intertwined. Problems are represented as being composed of interconnected *n*-component elements of a general type. A reversed use of index registers (such as is frequently used in subroutine linkages) is described which provides a computer technique that appears to include all known symbol manipulation techniques as simple subcases and is ideally suited to both symbolic and numerical operations. 4 refs.

1427 **Monte Carlo.** C. E. Clark, *Commun. ACM,* **4,** March 1961, 141. Brief summary of research at System Development Corporation with the objective of creating efficient sampling procedures that will reduce the cost of Monte Carlo analyses. 4 refs.

1428 **Multiple-precision division.** P. Rabinowitz, *Commun. ACM,* **4,** Feb. 1961, 98. In a certain problem involving the computation of matrix elements for the three-body problem, in quantum mechanics, it was found desirable to have a subroutine for *n*-tuple precision arithmetic where *n* was a parameter which could be varied during the course of the program. A brief description is given of the technique used in the part of the subroutine for performing division. 1 ref.

1429 **Multiple regression on E.D.P. equipment and its industrial applications.** C. R. Newell, *Computing & Data Processing Soc. Canada 2nd Conference Proc.,* 1960, 109-120. This paper describes multiple regression technique and its use on digital computers such as the IBM 650 and the Datatron for finding a relationship between a variable which it is desired to control and one which can be controlled. Applications by the Norton Company of Canada Limited to process control with feedback and to inventory control are discussed. 6 refs.

1430 **Orthotronic Control.** O. M. Rye, *Data Processing (Detroit),* **3,** May 1961, 14-17. An explanation, in general terms, of the operation and effect of Orthotronic Control, the error correction system employed by the Honeywell 800 and 400 for magnetic tape operations.

1431 **Round-off.** C. A. Piper, *Commun. ACM,* **4,** March 1961, A13. Letter pointing out that the Bendix G-20 contains a hardware round-off rule essentially the same as one of the rounding-off procedures mentioned in a letter by R. Silver, *ibid,* **3,** Dec. 1960, A9 (*C.A.,* **5,** Feb. 1961, Ref. 265).

1432 **Two subroutines for symbol manipulation with an algebraic compiler.** J. W. Carr and J. W. Hanson, *Commun. ACM,* **4,** Feb. 1961, 102-103. Although the IT and GAT languages are not basically designed for symbol manipulation work, two simple symbol decomposition and recomposition subroutines described in this paper, enable symbol manipulation problems to be handled satisfactorily. The key to the process is the insertion of the two subroutines into the language. This allows the decomposition of the input words into a sequence of words with one symbol per word and the inverse operation of recomposition. Manipulation of one symbol per word by means of the fixed-point operations of the IT and GAT compilers allows easy writing of a large range of symbol manipulation problems. As well as a description of the two subroutines written for the IBM 650, the paper gives an example of a GAT-like language program to read in symbols from punched cards, count the number of occurrences of the letter 'S' in the first sentence and print out the sentence in reverse. 3 refs.

1433 **Word inversion.** P. E. Des Jardins, *Commun. ACM,* **4,** March 1961, A13. Correction to the author's article describing a method for word inversion on the IBM 709, *ibid,* **3,** Dec. 1960, 658 (*C.A.,* **5,** Feb. 1961, Ref. 275).

1434 **Coding instructions for floating point trigonometric, inverse trigonometric, hyperbolic and exponential functions.** B. A. Jensen, M.I.T., *PB 153052,* 1 Nov. 1960, 8 p. The addition of the trigonometric, inverse trigonometric, exponential and hyperbolic functions to the floating point program of the CG 24 computer provides the programmer with a method of doing many computations that formerly required desk calculators. The rules for writing the instructions are simple, programming time is reduced, numbers are written in the ordinary decimal form $\pm$ 23.9 x 10^8, seven significant decimal figures are kept during the computation, and the answers can be printed out at the machine in decimal form. Any computation involving addition, subtraction, multiplication, division, square root, sin, cos, tan, cot, sec, csc, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, $\cot^{-1}$, $\sec^{-1}$, $\csc^{-1}$, e^x, e^{-x}, sinh, cosh, tanh, coth, sech, csch and requiring an accuracy of seven significant decimal figures can thus be carried out on the CG 24 computer.

1435 **The effect of limiting the number of iterations on a principal axes factor analysis solution.** H. W. Burk, Washington University, Seattle, *PB 153132,* Feb. 1960, 58 p. Using a mathematical rationale developed by Horst, data from several sources, and a program written by Lunneborg and Wright which allows loading matrices were found for several matrices using different iteration limits. From the results, it appears that limiting iterations can be a useful procedure, but the ultimate usefulness of the procedure will depend on the nature of the original data and the purposes of the experimenter. 18 refs.

1436 **Graphical manipulation techniques using the Lincoln TX-2 computer.** H. H. Loomis, M.I.T., *PB 153485,* 10 Nov. 1960, 28 p. Results of an investigation into the use of a computer-controlled oscilloscope display for graphical manipulation, including symbol drawing and positioning of symbols to form a drawing, are reported. The structure and operation of a program to draw symbols and to use these symbols for the construction of a drawing are discussed. Finally, the type of program which would aid the logical designer in his logical circuit design by preparing and filing the drawings and analysing the circuits for such items as signal delays and unit loading factors is discussed in brief. 3 refs.

1437 **An IBM 650 program for a complete paired comparisons schedule (PARCOPLET-2-21).** H. Gulliksen, Educational Testing Service, Princeton, *PB 147363,* May 1960, 4 p. In order to facilitate analysis of paired comparison data, an IBM 650 program was prepared that will handle a complete paired comparison schedule for any number of objects up to and including 21. It is also possible to append and analyse an absolute judgement set of data in which the subject classifies the stimuli into two categories as positive or negative, like or dislike. A checking program was also prepared to insure that the data cards are in proper form. 2 refs.

1438 **Roundoff-error accumulation in iterative procedures.** R. T. Gregory and A. H. Taub, Digital Computer Lab., University of Illinois, *PB 153415,* 31 Oct. 1960, 12 p.

1439 **A study of redundant number representations for parallel digital computers. Thesis.** A. Avizienis, University of Illinois, *TID-6168,* May 1960, 82 p.

See also :—
Mathematics, Ref. 1416.
Programming, Ref. 1504.
Applications: Simulation, Refs. 1575*a*, 1575*e*, 1575*g*, 1575*h*.
Transport, Ref. 1577. **Miscellaneous,** Ref. 1584.

ACCESSORIES

1440 **High-speed tape strip reader.** E. J. Wroblewski, *IBM Technical Disclosure Bull.,* **3,** May 1961, 7-8. Description of a magnetic tape strip reader which employs a hollow perforated cylinder rotatable in either direction. Positioned near the inner surface of the cylinder are a read-write head and a tape strip cartridge containing a spool carrying the tape strip. By rotating the cylinder and applying vacuum to certain perforations the tape strip is removed completely from the cartridge and loaded onto the inner surface of the cylinder. By applying air pressure to perforations opposite the read-write head the tape strip is blown into contact with the head. When required the tape strip is loaded back into the cartridge by suitable application of vacuum and air pressure to the perforations of the cylinder.

1441 **Historical scanner.** E. I. Jordan, *IBM Technical Disclosure Bull.,* **3,** May 1961, 36-37. Description of a historical scanner which monitors a data processing machine and provides a complete history of the machine condition for a given number of operations prior to the one being performed. The scanner includes a magnetic core memory unit and upon a selected indication, such as an error signal from the computer, the operation of the scanner is stopped and the memory unit contains the computer history for nine time steps prior to the occurrence of the indication. The information stored in the memory unit can then be read out at low speed and recorded for use in determining the cause of the computer error.

1442 **Magnetic tape loop auto-load memory.** C. Handen, *IBM Technical Disclosure Bull.,* **3,** May 1961, 9-10. Description of a device employing a semicircular vacuum manifold to automatically load an endless magnetic tape loop on to a rotary drum which transports it past a magnetic head.

1443 **Maintenance scanner.** W. R. Stringfellow, J. D. McNeill and P. H. Baumgarte, *IBM Technical Disclosure Bull.,* **3,** May 1961, 19-20. When an error due to component failure is detected and corrected in a section of a large data processing system, it is desirable to ascertain the machine condition when the error occurred. A maintenance scanner is described which acts, when manually enabled, to halt operations in a section selected to avoid interruption of other functions. It enables a fast storage of the condition of the section and then releases the section for continued operation.

1444 **Pneumatic drum.** R. P. Auyang, *IBM Technical Disclosure Bull.,* **3,** May 1961, 6. Brief description of a device in which a perforated cylinder or drum is used for transporting a short, magnetisable record strip past a magnetic read-write head. The strip is held against the cylinder for movement therewith by applying vacuum to certain of the perforations and is blown against the head by applying air pressure to other perforations.

1445 **System considerations for the use of random access storage equipment.** C. H. Rust, *Computing & Data Processing Soc. Canada 2nd Conference Proc.,* 1960, 356-365. This paper discusses the use of random access storage with particular reference to the IBM RAMAC system. Economic and other factors to be considered when deciding upon random access storage are briefly examined. File organisation and systems checking are discussed and, finally, certain special applications are outlined. 3 refs.

1446 **The design of an "error-free" data transmission system for telephone circuits.** B. Reiffen, W. G. Schmidt and H. L. Yudkin, M.I.T., *PB 153803,* 22 Dec. 1960, 30 p. Recent experimental results verify that easily implemented codes can detect essentially all errors occurring in digital data sent over toll grade telephone circuits. A two-way communications system is described which uses these codes to detect the occurrence of errors and requests a retransmission of any data in error. The feedback logic is described in detail and the buffer required to adapt the system to various data sources is discussed. Extrapolated experimental results indicate that the system will deliver data in each direction at an average rate of approximately 7/8 the modem bit rate with a mean time to error of several hundreds of years. 12 refs.

1447 **Static reading of magnetically stored digital information.** S. M. Rubens, Engineering Research Associates, Inc., *PB 154747,* 21 Aug. 1951, 34 p. It has been demonstrated that the harmonically-variable reluctometer type of static reading device can be used satisfactorily to read magnetically recorded binary digital information. With the circuits developed in this investigation, the device operates successfully and reliably for reading in contact records of 100 bits per inch or less (recorded in contact) so long as the equipment is in continual readiness for use (tubes "warmed up"). 1 ref.

1448 **Magnetic tape apparatus.** Int. Computers & Tabulators Ltd., *B.P. 867603,* 10 May 1961. This patent is concerned with circuit arrangements for transferring data in blocks from magnetic tape under the control of block end code signals recorded before and after each block.

1449 **Analogue coordinate converter.** Electric & Musical Industries Ltd., *B.P. 868196,* 17 May 1961. This patent describes circuitry for converting three carrier waves modulated to represent range coordinate and sine and cosine of bearing angle of a point into two alternating signals whose amplitudes represent the cartesian coordinates of the point.

1444 Coding information for floating point trigonometric, inverse trigonometric, hyperbolic and exponential functions. R. A. Jansen, Sci.J.T., 72 (3):72, 1 illus, 1960. 8 p. The solution of the trigonometric, inverse trigonometric, exponential and hyperbolic functions to the floating point precision of the CC 24 computer provides the programmer with a method of doing many computations that formerly required desk calculators. The rules for writing the instructions are simple, programming time is reduced, numbers are written in the ordinary decimal form ... 2.3.9 x 10^5, seven significant decimal figures are kept during the computation, and the answers are so printed out at the machine in decimal form. Any computation involving addition, subtraction, multiplication, division, square root, sin, cos, tan, sec, csc, cot, arc sin, arc cos, arc tan, arc sec, arc csc, arc cot, sinh, cosh, tanh, coth, sech, csch, arc sinh, arc cosh, arc tanh, arc coth, arc sech, arc csch, exp, ln, log, and powers with real and negative exponents of seven significant decimal figures can thus be carried out on the CC 24 computer.

1445 **The effect of limiting the number of iterations on a principal axes factor analytic solution.** H. W. Burt. Washington University, Seattle, Wa. AD 132132, Feb. 1960. 29 p. Using a mathematical rationale developed by Thurstone, data from several sources, and a program written by Armstrong and Wrigley, allowing leading matrices were found for several factoring solutions differing in iteration limits. From the results, it appears that factoring iterations can be a costly procedure, and the ultimate usefulness of the procedure will depend on the nature of the original data and the purpose of the computation. 12 refs.

1446 **Graphical manipulation techniques using the Lincoln TX-2 computer.** H. H. Loomis, MIT. Lincoln Lab. 30 Nov. 1960. 28 p. Results of an investigation into the use of a computer controlled oscilloscope display for graphical manipulation, including symbol and drawing and positioning of symbols to form a drawing, are reported. The structure and operation of a program to draw symbols and to use these symbols for the construction of a drawing are discussed. Finally, the type of program which would aid the logical designer in his logical circuit design by inputting and filing the drawings and analyzing the circuits for such things as signal delays and one loading factors is discussed in brief. 7 refs.

1447 **An IBM 650 program for a complete patrol comparisons schedule (PARCOMP).** E. F. Codd, Computing Laboratory, U.S. Army Service, Princeton, N.J. 74-243, May 1960. 4 p. In order to facilitate analysis of patrol comparisons data, an IBM 650 program was prepared that will handle a complete patrol comparison schedule for any number of objects up to and including 21. It is also possible to append and analyze an arbitrary large amount of data to the output classifies the patrols into two categories as positive or negative. IBM or Bendix. A description was also prepared to ensure that the data cards are in proper form. 2 refs.

1448 **Monadic-error accumulation in iterative procedures.** R. T. Gregory and A. H. Tate. Digital Computer Lab., University of Illinois. AD 124215, 31 Oct. 1960. 12 p.

1449 **A study of redundant number representations for parallel digital computers.** Thesis. A. Avizienis. University of Illinois. 77D-0147, May 1960. 82 p.

See also —
Mathematics, Ref. 1418.
Programming, Ref. 1426.
Applications - Simulation, Refs. 1475, 1477, 1478, 1479.
Transport, Ref. 1527. Miscellaneous, Ref. 1581.

1450 **Hydrogen tube trip cycle.** R. J. Overbeek. AD 132132, Technical Documentary Rpt. No. 61-1, Jan. 1961. 2 p. Discussion of a magnetic tape drive cycle which will permit the tape to be moved in either direction, reversing over the tape surface of the cylinder as it is rotating. Read and write heads are mounted on a cartridge oscillating a short distance along the tape with the cylinder and moving system on certain programmed commands. The tape is removed tangentially from the cylinder and passed around a capstan before it is wound on the hub of the cylinder. By applying a vacuum to perforations near the read-write head the tape is drawn into contact with the head. When tape is to be stopped it is loaded back into the cassette by applying a vacuum and air pressure to the perforations on the cylinder.

1450 **Magnetic head.** Int. Computers & Tabulators Ltd., *B.P. 869032*, 25 May 1961. A reading head is provided with a control winding for rendering it operative or inoperative.

1451 **Magnetic tape file system.** Radio Corp. of America, *U.S.P. 2967296*, 3 Jan. 1961. This patent is concerned with arrangements for extracting a particular message from a large-scale magnetic tape storage system.

1452 **Testing analogue computers.** Reeves Instrument Corp., *U.S.P. 2967997*, 10 Jan. 1961. Apparatus is described for speedily checking the operation of an analogue computer without disturbing the set-up.

1453 **Buffer storage system.** Int. Business Machines Corp., *U.S.P. 2968791*, 17 Jan. 1961. An extensive description is given of a buffer storage system which performs various checking and sorting functions in addition to its storage function; words in storage which fail to check are not delivered from buffer storage.

1454 **Magnetic recording system.** Int. Business Machines Corp., *U.S.P. 2968792*, 17 Jan. 1961. Arrangements are described for storing on a magnetic drum or the like, messages of variable length without waste of storage capacity.

1455 **Magnetic recording head.** Burroughs Corp., *U.S.P. 2969529*, 24 Jan. 1961. A head for reading and writing simultaneously on magnetic tape or the like.

ELEMENTS

1456 **Core storage lockout circuit.** E. J. Annunziata, J. E. Ewing and T. J. Gallagher, *IBM Technical Disclosure Bull.*, **3,** May 1961, 21. A brief description of an addressable core storage lockout circuit which selectively prevents storage in a selected area of a memory.

1457 **Fluxlok high-speed core memory.** R. M. Tillman, *Instr. & Control Systems*, **34,** May 1961, 866-869. An account is given of the Fluxlok memory technique which employs solenoid-produced magnetic fields for writing on and non-destructive reading of ferrite cores. Orthogonal (crossed-field) writing is effected by simultaneous currents in the read solenoids and sense wires. 9 refs.

1458 **Latch register with internal transition storage.** O. L. MacSorley, *IBM Technical Disclosure Bull.*, **3,** May 1961, 22-23. If a long shift register is driven by a basic signal controlling several parallel power drivers, the skew in the driver signals may exceed the logic delay in the register orders and cause a single bit to be shifted more than one position. A description is given of a shift register which provides an internal delay in each register order to prevent, for a period longer than any normally allowed skew, a change in the output of a register order due to an input signal.

1459 **Latch with positive logic reset.** R. H. Dietrich, *IBM Technical Disclosure Bull.*, **3,** May 1961, 32-33. Description of a transistor latch circuit in which a positive signal on the reset terminal resets the latch regardless of the polarity of the signal applied to the set terminal.

1460 **Magnetic cores, characteristics and applications.** R. Stuart-Williams, *Auto. Control*, **14,** May 1961, 56-61. The second of a series of articles (for first article see *C.A.*, **5,** June 1961, Ref. 1205) intended to provide reference material for engineers concerned with the design and application of magnetic core storage and switching units. This article is concerned with data storage matrices and discusses the principles of coincident current selection, operation of a number of matrices in parallel, behaviour of minor loops in storage cores and design of sense windings.

1461 **Multi-state memory cell.** C. H. Stapper, *IBM Technical Disclosure Bull.*, **3,** May 1961, 40-41. Description of a memory cell which employs n tunnel diodes and n backward diodes and has $n + 1$ stable states.

1462 **Thin magnetic film logic.** W. E. Proebster and A. P. Speiser, *IBM Technical Disclosure Bull.*, **3,** May 1961, 18. A logical thin film, rotational switching system performing inversion is described. Three magnetic elements are positioned one over the other with each exhibiting a similar easy axis of magnetisation in the plane of the respective elements.

1463 **Application of the magnetoresistance effect to analog multiplication.** J. M. Hunt, Stanford University, *PB 149333*, 25 May 1960, 132 p. This report is concerned with a study of the bounds on the performance of a magnetoresistance. Emphasis has been placed on the following areas: analysis of multiplier error in terms of constituent errors; theoretical analysis of the source of certain errors caused by imperfections in the paired magnetoresistor unit which is the novel element of the multiplier; and fabrication and test of sufficient magnetoresistor elements to permit the establishment of a realistic bound on the error component contributed by these elements. Attention was also devoted to methods for minimising multiplier errors without recourse to external corrective circuitry. 10 refs.

1464 **Applications of tunneling to active diodes.** N. Holonyak, General Electric Co., *PB 153873-2*, Oct. 1960, 67 p. This report covers the results obtained to date in studies of tunneling due to states (bands) in the "forbidden-gap" of GaAs and InP, describes a reliability-failure property in GaAs tunnel diodes which bears some resemblance and possibly relationship to formation of "forbidden gap" states, outlines a method of regrowing and doping GaAs (and potentially other compounds) from an alloy-vapour state, and presents some initial results in growing various intermetallic compounds (including epitaxial growth of GaAs) via reaction with a halogen in a closed quartz tube. Circuits that have been studied are as follows: general purpose logic, sequential circuits, pulse generators and drivers, memory and active RC filters. Results to date indicate that the practical applications of tunnel diodes are limited. 9 refs.

1465 **The development of a photomemory.** E. St. George, C. E. Nielsen and E. P. Johnson, Hydel Inc., *PB 147756*, 1960, 106 p. Contents: Data storage and retrieval—the photomemory in hybrid data retrieval, The photomemory in digital data retrieval; Mechanical language translation — Characteristics of photomemory storage for mechanical translation, Requirements for photomemory writing; Development of a reading system—Optical system, Electronic system, Demonstration system; Writing system development—Photographic materials, Test plate preparation, Mechanical writing systems, Electronically timed writing system, Data input. 13 refs.

1466 **Thin film magnetization reversal studies.** R. L. Conger, Naval Ordnance Lab., Corona, California, *PB 150073*, Sept. 1958, 18 p. The suitability of very thin evaporated magnetic alloy films for use in coincident memory devices in high-speed digital computers is shown. A method of preparing such films is outlined, and two methods of utilising them in memory devices are presented. The process of magnetisation reversal in thin films is discussed. 5 refs.

1467 **Analogue circuit for flow simulation.** Montan-Forschung G.m.b.H., *B.P. 866981*, 3 May 1961. This patent describes a circuit for simulating the flow of a fluid in ducts, more particularly for use in the construction of analogue networks for simulating the flow of air through the underground galleries and roads of a ventilated mine.

1468 **Transistor circuit.** Int. Computers & Tabulators Ltd., *B.P. 867526*, 10 May 1961. In a pulse circuit, a clock pulse is supplied to the collector of a transistor through the primary of a transformer, the secondary of which provides the output pulse.

1469 **Shift register.** Int. Computers & Tabulators Ltd., *B.P. 867997*, 10 May 1961. A shift register operable in either direction, employs a pair of magnetic amplifiers in each stage.

1470 **Magnetic core storage device.** United Kingdom Atomic Energy Authority, *B.P. 868549*, 17 May 1961. High switching speed is attained with a device comprising a main magnetic core tightly coupled to an auxiliary core by a loop which includes a winding on each core.

1471 **Analogue integrator.** Tesla N.P., *B.P. 868612*, 25 May 1961. A double integrator employing a single d.c. amplifier including in its feedback loop a T-network of two capacitors and a resistor, is described.

1472 **Data storage device.** Ferranti Ltd., *B.P. 868775*, 25 May 1961. A device for the permanent or semi-permanent storage of data, employs two sets of conductor pairs which cross to form storage locations at which data is stored by inserting a piece of ferromagnetic material.

1473 **Serial binary divider.** Nat. Research Development Corp., *B.P. 868840*, 25 May 1961. Circuitry is described for effecting division of a binary number represented in serial form by an odd divider of small value, particularly 3 or 5.

1474 **Shift register.** Int. Computers & Tabulators Ltd., *B.P. 868854*, 25 May 1961. Each stage of a shift register comprises a closed loop around which stored signals circulate so that the stage can store two or more bits.

1475 **Data storage device.** Pye Ltd., *B.P. 868858*, 25 May 1961. A data storage device of the coherer type comprises two wire electrodes crossing each other with a gap between them and surrounded, in the crossing area, by a finely divided metal.

1476 **Analogue computing unit.** Gen. Precision Inc., *U.S.P. 2967018*, 3 Jan. 1961. Analogue computing circuitry is described for producing an output potential commensurate with the time integral of the product of two independent quantities which vary with time.

1477 **Shift register.** Briggs Associates Inc., *U.S.P. 2967250*, 3 Jan. 1961. A shift register employs one transistorised flip-flop per bit and is designed so as not to be critically responsive to data pulse lengths or shift pulse periods.

1478 **Switching circuits.** Philco Corp., *U.S.P. 2967951*, 10 Jan. 1961. Improved circuit arrangements employing two transistors for bistable, monostable and astable multivibrators are described.

1479 **Shift register.** W. Shockley, *U.S.P. 2967952*, 10 Jan. 1961. A shift register is described which employs a common body of semiconductor material and several semiconductor devices forming junctions with the body.

1480 **Reversible counter.** Int. Business Machines Corp., *U.S.P. 2968003*, 10 Jan. 1961. In a binary counter which is reversible, a self-generating carry pulse is provided for each stage so that the operating speed of the counter is limited only by the rate of response of the individual stage.

1481 **Magnetic core matrix.** North American Philips Co., Inc., *U.S.P. 2968029*, 10 Jan. 1961. A magnetic core matrix is described which is designed to act as a permanent memory such as is required for the storage of a fixed program.

1482 **Magnetic core flip-flop.** Burroughs Corp., *U.S.P. 2968030*, 10 Jan. 1961. A bistable circuit or flip-flop employs two multi-aperture magnetic cores providing negation functions.

1483 **Cryotron memory.** Arthur D. Little, Inc., *U.S.P. 2968794*, 17 Jan. 1961. Arrangements are described for modifying the information stored in a prewired cryotron memory.

1484 **Shift register.** Radio Corp. of America, *U.S.P. 2968795*, 17 Jan. 1961. A simplified circuit is described for a shift register employing transfluxors.

1485 **Magnetic core counter.** U.S. Secretary of the Army, *U.S.P. 2968797*, 17 Jan. 1961. A binary counter employing four magnetic cores is described.

1486 **Multi-aperture magnetic cores.** Gen. Electric Co., *U.S.P. 2969523*, 24 Jan. 1961. A flux control system is described for a multi-aperture magnetic core.

1487 **Shift register.** Burroughs Corp., *U.S.P. 2969524*, 24 Jan. 1961. A bidirectional shift register employs multi-aperture magnetic cores.

1488 **Binary counter.** Sperry Rand Corp., *U.S.P. 2970293*, 31 Jan. 1961. A binary counter employing a pulse-type magnetic amplifier.

1489 **Shift register.** Raytheon Co., *U.S.P. 2970294*, 31 Jan. 1961. A shift register employs magnetic cores coupled by specified transfer circuits.

1490 **Magnetic core matrix.** Int. Business Machines Corp., *U.S.P. 2970296*, 31 Jan. 1961. A matrix is produced by potting magnetic cores in cavities in a printed circuit board.

ANALOGUE

1491 **The ESIAC potential-plane analog computer.** J. C. Looney, *Auto. Control*, **14,** May 1961, 45-50. 55. An account is given of the ESIAC analogue computer produced by Electro Scientific Industries Inc., which uses the principle of the potential-plane analogue and is specifically designed to solve agrebraic equations of complex variables. 2 refs.

DIGITAL

1492 **The Atlas computer.** C. H. Devonald and J. A. Fotheringham, *Datamation*, **7,** May 1961, 23-27. An account of the main features of the Ferranti ATLAS.

1493 **Automatic parallel processing.** S. D. Harper, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 321-331. After outlining the evolution of digital computers from the point of view of performing several programs simultaneously on a single on-line data processor, an account is given of the features of the Honeywell 800 which permit automatic parallel processing, it being possible to run up to eight programs simultaneously without combining them into a 'super-program'.

1494 **Auxiliary processors speed large-scale computing system.** H. I. Cohen, *Control Engng.*, **8,** May 1961, 137-139. A description is given of how in the Sylvania 9400 data processing system, efficient use of central processor and main memory is achieved by means of small-scale input-output processors connected to the main data transfer bus of the system. There can be up to four such auxiliary processors and each can control up to 64 input or output devices.

1495 **Design of the B 5000 system.** W. Lonergan and P. King, *Datamation*, **7,** May 1961, 28-32. An account is given of the system organisation of and the programming package for the Burroughs B 5000 digital computer system whereby the major design objectives of this system are achieved. These objectives are the reduction of total problem through-put time and the facilitation of changes both in program and system configurations.

1496 **The DRTE solid state digital computer.** C. D. Florida. *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 299-310. This paper gives a general description of the general purpose digital computer designed and built by the Defence Research Telecommunications Establishment (DRTE) of the Canadian Defence Research Board. The computer which employs transistors, diodes and a random access ferrite core memory, has floating point arithmetic and a three-address code.

1497 **The properties of the Bendix G-20 executive program system.** A. J. Perlis, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 338-345. This paper is concerned with the executive program system of the Bendix G-20 and sets out to show how the design of that computing system affects the design of code systems to operate on it.

1498 **Binary computer.** Radio Corp. of America, *U.S.P. 2968439*, 17 Jan. 1961. This patent describes the arrangements in a binary computer for performing quickly addition, subtraction, multiplication and division.

See also :—
Programming, Ref. 1502.

PROGRAMMING

1499 **ALGOL translation for KDF9.** F. G. Duncan, *Auto. Programming Information*, No. 7, May 1961, 31-34. After a brief description of the KDF9, an account is given of work in progress on ALGOL translators for this computer.

1500 **An alternate form of the "UNCOL diagram".** H. Bratman, *Commun. ACM*, **4,** March 1961, 142. A form of UNCOL diagram is described for showing clearly the transformations made by generators, translators and compilers and which can be used to show, for example, how a JOVIAL generator for the IBM 709 can produce a JOVIAL translator to the Philco S-2000 that will run on the 709 and then use the resulting 709/S-2000 translator to produce a JOVIAL translator to the S-2000 that will run on the S-2000. 1 ref.

1501 **Automatic coding.** H. Bratman, *Commun. ACM*, **4,** March 1961, 140. Summary of research, particularly of the CLIP language and compiler, having as objectives the development of a language to express problems (typically information processing problems) that are of interest to System Development Corporation and the investigation of various designs for compiler processors. 5 refs.

1502 **The BKS system for the Philco-2000.** R. B. Smith, *Commun. ACM*, **4**, Feb. 1961, 104, 109. An account is given of the BKS system, a program sequencing system designed for the Philco 2000 to meet operational requirements of the Bettis and Knolls Atomic Power Laboratories. The system controls loading of independent programs from either cards or the master system tape, provides common functions required by most programs, assigns all logical tapes to available physical tape transports, and directs the mounting and removal of all file tapes.

1503 **Comments from a reader of "Comments from a FORTRAN user".** J. L. Rogers, *Commun. ACM*, **4**, Feb. 1961, A14-A16. Letter referring to 'Comments from a FORTRAN user', J. M. Blatt, *ibid*, **3**, Sept. 1960, 501-505 (*C.A.*, **4**, Nov. 1960, Ref. 2208). Although agreeing with some of Dr Blatt's conclusions as to the features required in a compiler, the writer disagrees with the classification of compilers into two types, one for users with little or no coding experience and the other for users with a great deal of coding experience. The writer suggests that no algebraic compiler is designed exclusively for one type of user and takes as an example the Burroughs Algebraic Compiler for the Burroughs 220. (See also *C.A.*, **5**, June 1961, Ref. 1258).

1504 **A compiler for solving systems of linear differential equations.** P. G. Ardouin and G. Lapierre, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 276-298. This paper is concerned with a compiler developed by Canadair Limited for handling on the Datatron 205, problems involving linear differential equations. The compiler is limited to nine second-order equations or 18 first-order equations, the maximum number of defined points of discontinuity is 20, and the maximum order for any polynomial in the forcing function is 6. The compiler was devised, in particular, to deal with the solution of systems of linear differential equations arising in the analysis of the dynamics of aircraft. After describing three typical problems concerned with the loads in the wing of an aircraft on landing, dynamic loads due to engine failure, and cargo dynamic loading, the specification of the compiler is given and the manner in which it is used is described. A sample problem is outlined.

1505 **Computer languages for heuristic processes.** A. Hormann, *Commun. ACM*, **4**, March 1961, 138. Brief summary of the ROVER system (a simulated computer and the information processing language used by it) designed by System Development Corporation as a step in research into heuristic processes suggested by human problem-solving activity. 1 ref.

1506 **Letter.** B. Arden, B. Galler and R. Graham, *Commun. ACM*, **3**, June 1960, A13. Comments on and criticisms of ALGOL 60. See also Ref. 1508.

1507 **Letter to the editor.** H. Isbitz, R. Anderson, E. Book, H. Bratman, W. Dobrusky, D. Englund, H. Manelowitz, and S. Shapiro, *Commun. ACM*, **3**, Sept. 1960, A13, 506. Some critical remarks and queries provoked by the report on ALGOL 60. See also Ref. 1508.

1508 **Answers to comments on ALGOL 60.** P. Naur, *Commun. ACM*, **4**, Feb. 1961, A16-A17. Letter giving answers to comments on and criticisms of ALGOL 60 contained in Refs. 1506 and 1507. An answer is also given to a query regarding inner-product raised by G. E. Forsythe (see *C.A.*, **5**, Jan. 1961, Ref. 62).

1509 **Logical structure of compilers.** S. P. Levine, *Commun. ACM*, **4**, March 1961, 139. Brief summary of the author's project which has the aim of describing with some generality the transformation that maps a computer program written in a convenient non-machine language into a machine language program. 1 ref.

1510 **Making a translator for ALGOL 60.** E. W. Dijkstra, *Auto. Programming Information*, No. 7, May 1961, 3-11. This paper describes the construction of a translator for ALGOL 60 based on the author's experience in making such a translator for the X1 computer of the Mathematical Centre at Amsterdam.

1511 **Multiple programming data processing.** B. L. Ryle, *Commun. ACM*, **4**, Feb. 1961, 99-101. After briefly discussing what is meant by multi-programming, and its value and cost, the design requirements of a multi-program system are listed. Systems which constitute examples of three types of multi-program systems are briefly described and each is compared against the design requirements and its advantages and disadvantages listed. The three types of system are: central memory, multiple control (GAMMA 60); multiple memory, central control (Honeywell 800); multiple memory, multiple control (RW 400).

1512 **An open letter to Bob Bemer.** R. De La Briandais, *Commun. ACM*, **4**, March 1961, A12. Letter saying that a more sophisticated compiler than FORTRAN is urgenly needed and that IBM should give a lead to the industry by releasing an ALGOL compiler. See Ref. 1513 for an answer to this letter.

1513 **Re: Rene De La Briandais' letter on FORTRAN.** R. W. Bemer, *Commun. ACM*, **4**, March 1961, A12-A13. Letter replying to that of Ref. 1512 and pointing out some of the difficulties in the way of releasing ALGOL processors at present.

1514 **Problem-oriented programming language structure.** R. Goldfinger, *Commun. ACM*, **4**, March 1961, 138. Brief summary of the activities of the Language Structure Group of CODASYL (Conference on Data Systems Languages).

1515 **Programming for business systems.** H. S. Gellman, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 257-264. This paper discusses three requirements which the author considers essential to reduce the cost of programming (taken here to include system analysis, system design, flow charting, writing detailed instructions, debugging the program, and preparing a complete, detailed description of the program) of electronic data processing systems. These requirements are: selection and training of capable programmers; provision of proper tools and working conditions; efficient organisation, direction and administration of the programmers. 3 refs.

1516 **Some uses of Jensen's device for ALGOL 60 procedures.** P. Naur, *Auto. Programming Information*, No. 7, May 1961, 12-13(b). This paper discusses the use of a device suggested by Jorn Jensen, which is a method of supplying a functional relationship as input to a procedure. Two procedures are given in ALGOL:

1. **Quadrature (integration) by the Parabolic Rule.** Evaluates the definite integral of a function by the Parabolic Rule (Simpson's Rule applied to subintervals).
2. **Rootfinding by bisection.** Solves the equation F=O for x in the interval a to b by a continued bisection.

1517 **Summary of main features of ALGOL 60.** M. Woodger, *Auto. Programming Information*, No. 7, May 1961, 14-30. The main features of ALGOL 60 are outlined and examples are given of their use. There are also three problems with solutions.

1518 **Universal Computer-Oriented Language.** W. B. Dobrusky and T. B. Steel, *Commun. ACM*, **4**, March 1961, 138. Brief summary of research directed towards the development of an UNCOL (Universal Computer Oriented Language) as an intermediate language between problem-oriented languages and machine languages. 1 ref.

1519 **GQS. General single-server queue-simulation compiler.** G. W. Armerding, M.I.T., *PB 153681*, July 1960, 61 p. A description is given of GQS, a general queue-simulation compiler program constructed for the IBM 704. The compiler generates a simulation program for any one of a number of specifiable single-server queuing operations. Inter-arrival times at each of a number of queues may be exponential, erlang, hyperexponential, normal, rectangular or constant and these distributions may be assigned non-stationary parameters. Service-times may be chosen from any of these distributions, also with non-stationary parameters, and service-times may be compounded through probabilistic chains. Priority of service may be assigned by input queue. 17 refs.

See also :—
Digital, Ref. 1497.
Books, Ref. 1587.

APPLICATIONS

AERONAUTICAL

1520 **Methods for the control of satellites and space vehicles. Volume I: Sensing and actuating methods.** R. E. Roberson (Ed.), Systems Corp. of America, *PB 171496*, 31 July 1960, 443 p. This report presents a survey of sensors and actuators for the attitude control of space vehicles. 203 refs. See also Ref. 1521.

1521 **Methods for the control of satellites and space vehicles. Volume II. Control system mechanization and analysis.** R. E. Roberson (Ed.), Systems Corp. of America, *PB 171553*, 31 July 1960, 300 p. This report presents information of importance to the synthesis of space vehicle attitude control systems and includes, *inter alia*, system response studies with the analogue computer. 183 refs. See also Ref. 1520.

1522 **A stability analysis of tilt-wing aircraft (analytical).** C. H. Tromwell and H. E. Payne, Princeton University, *PB 149354*, May 1960, 176 p. This report presents a general development of methods for predicting the aerodynamic stability derivatives of propeller-driven tilt-wing vertical take-off and landing aircraft. It includes reference to the use of an analogue computer for calculation of the stability roots and determination of the aircrafts' characteristic response. 10 refs.

See also :—
Programming, Ref. 1504.
Military, Refs. 1556 and 1557.
Simulation, Ref. 1575*c*.

BUSINESS

1523 **The business game—the new dimension in management development.** V. B. Allen, *Computing & Data Processing Soc. Canada 2nd Conference Proc.,* 1960, 332-337. The features and advantages of the business game are examined in the light of problems facing Canadian management.

1524 **On the calculation of the interest.** F. G. Duncan, *Commun. ACM,* **4,** March 1961, A13. Letter referring to 'A note on the calculation of interest', P. Z. Ingerman, *ibid,* **3,** Oct. 1960, 542-543 (*C.A.,* **5,** Jan. 1961, Ref. 163) and pointing out ways in which an algorithm contained in that note appears not to be in standard ALGOL 60.

1525 **Experience in implementing a major application on an E.D.P. system,** J. C. Davidson, *Computing & Data Processing Soc. Canada 2nd Conference Proc.,* 1960, 44-58. This paper discusses the experience of Confederation Life Association in using an IBM 705 for life insurance processing. Topics considered include the overall organisation of a data processing system, conversion to the new system, programming, operation of the computer, and personnel.

1526 **Highway maintenance costing.** G. F. Gibson, *Computing & Data Processing Soc. Canada 2nd Conference Proc.,* 1960, 226-242. This paper is concerned with the recording on IBM cards of highway maintenance costs to enable the Ontario Department of Highways to control expenditure in the most efficient and economical manner. The paper consists almost completely of flow charts and specimen forms.

1527 **Organizing for company-wide clerical automation.** H. J. M. Watson, *Computing & Data Processing Soc. Canada 2nd Conference Proc.,* 1960, 83-92. This paper is concerned with the organisation of a large-scale business data processing system. Requirements as to over-all plan, staff and control are discussed. The Steel Company of Canada Limited has set up a department to control the total systems effort of the company; the responsibilities are outlined of the sections dealing with the basic functions of planning, systems and procedures, programming, operating, and control.

1528 **The role of service bureaux.** K. Bean, *Auto. Data Processing,* **3,** May 1961, 33-36. Concluding article of a series on automatic data processing in insurance (for other articles see *C.A.,* **5,** Refs. 802, 805, 806 and 1297). This article discusses considerations for sharing a computer by two or more insurance companies, describes work done at various computing service bureaux, and discusses the special problems of companies specialising in motor insurance and reinsurance.

1529 **This home-buying business.** R. McKinnon, *Auto. Data Processing,* **3,** May 1961, 16-19. First of three articles (for other articles see Refs. 1530 and 1531) investigating why building societies have shown little interest in automatic data processing. This article deals with how building societies operate and their special problems. It is stated that no building society uses or plans to use a computer and few use punched card equipment.

1530 **How the Alliance expanded—without strain.** R. McKinnon, *Auto. Data Processing,* **3,** June 1961, 27-30. An account of the use of punched card equipment by the Alliance Building Society. Plans of the Leicester Permanent Building Society to use an NCR 315 computer are briefly announced. See also Refs. 1529 and 1531.

1531 **Blueprint for computer operations.** R. McKinnon, *Auto. Data Processing,* **3,** July 1961, 30-32. Ways in which a building society might use a digital computer for data processing are suggested and some details are given of the NCR 315 system to be used by Leicester Permanent Building Society. See also Refs. 1529 and 1530.

1532 **Under daily control—14,000 components.** R. Wilcox, *Auto. Data Processing,* **3,** May 1961, 26-29. A general account of the use by Standard-Triumph International Limited of a LEO IIC for production stock control and costing of some 14,000 motor components. (See also *C.A.,* **5,** June 1961, Ref. 1298.)

1533 **Depot system simulator I. (Ordnance logistic study).** H. P. Galliher and L. H. Walker, M.I.T., *PB 153660,* Sept. 1960, 61 p. A simulation program was constructed for the IBM 704, which operates a geographic complex of cooperating depots stocking a given item of supply for a captive demand. Stationary random demand patterns of selected types are allowed at each of the individual depots. Under appropriate controlled conditions, stocked depots cover customers of depots with depleted stocks while bulk interdepot shipments are made to preserve balanced distribution. Periodic or continuous review of stock in the total complex is used to generate and allocate constant-lead-time replenishments of total stock. The simulation output includes a tabulation of average stocks, out-of-stock frequencies, covering and balancing actions among the depots, and average delivery delays due to stock shortages. It also includes a tabulation of costs incurred in each individual type of supply action. 1 ref.

See also :—
Programming, Ref. 1515.
Transport, Ref. 1578.

CHEMICAL

1534 **Computer simulation of aggregate formation.** M. J. Vold, University of Southern California, *PB 153667,* Aug. 1960, 20 p. Computer generated model sediments of spherical particles, formed by addition to the sediment of one particle at a time appeared in previous work to be adequate at the time to represent the behaviour of physical model systems composed of microscopic glass beads. However, sediment densities of semi-colloidal silica in hydrocarbon solvents are too low by a factor of about 30 to be represented by such a model. Observation suggests that a model must take flocculation and sedimentation into account simultaneously. This report concerns work in which model flocs were generated and their shapes, structures and densities explored. Particle by particle addition to the floc was assumed. A sediment formed on the previous pattern from these flocs rather than from primary particles is still more dense than experimental sediments but by a smaller factor (about 6). 4 refs.

See also :—
Medical, Ref. 1550.

CONTROL—PRODUCTION AND PROCESS

1535 **Priority interrupt in control computers.** S. B. Dinman and R. W. Sonnenfeldt, *Control Engng.,* **8,** May 1961, 127-131. The importance of the priority interrupt feature in digital computers for process control is explained. Simulated priority interrupt (special program subroutine) and implemented priority interrupt (logic wired into the computer) are described and compared. It is shown that implemented priority interrupt has, in the case of control applications, advantages in terms of safety and efficiency and mention is made of the special features of the system used in the RCA 110 control computer. Examples of the use of priority interrupt which are discussed are: running a preventative maintenance program (with lowest priority); checking whether a process alarm is due to computer malfunction before passing to alarm routine; preventing loss of computer data during a transient power failure.

1536 **Problems encountered and solved in starting up of computer control systems.** R. P. Adams, *IRE Trans. Industrial Electronics,* **IE-7,** Dec. 1960, 10-14. Techniques, which are in successful use, for improving the accuracy and fail-safe operation of digital computer process control systems. 3 refs.

1537 **Scheduling production in job shops.** J. N. P. Hume, *Computing & Data Processing Soc. Canada 2nd Conference Proc.,* 1960, 59-68. In this paper a system is proposed for the scheduling of production in a job shop which could be handled by a data processor. Its main feature is an attempt to schedule production in a manner which is feasible to execute as planned. It schedules into intervals which are longer than days and reschedules certain jobs to create a level load. The success of the scheme depends on an assessment of the proper length for the production interval (during which only one major operation takes places) in a particular job shop. 10 refs.

1538 **Step-by-step to the completely automatic plant.** R. W. May, *Control*, **14,** May 1961, 25-28. An account of Bailey Meter Company's 700 system designed to enable completely automatic control of a plant to be approached a step at a time, each sub-loop being perfected before all the sub-loops are tied together to form the completely automatic plant. The system includes a small digital computer (identified in a system diagram as p. 250).

ELECTRONICS

1539 **Digital computers for television automatic switching control.** A. B. Ettlinger, *IRE Trans. Broadcasting*, **BC-7,** March 1961, 29-36. The basic requirements for a television automatic switching control system are discussed and the limitations of present techniques are reviewed. A digital computer approach which is being adopted by CBS is then outlined. 6 refs.

1540 **Television switching control.** E. J. Schubert, *Control Engng.*, **8,** May 1961, 93-96. General requirements for a system for the automatic control of switching of television programmes are discussed and the organisation is outlined of a special purpose digital computer that could store switching sequences for the day of television programmes and carry them out in synchronisation with real time.

1541 **Use of digital computer to determine broadcast station nighttime interference.** I. Akerman, *IRE Trans. Broadcasting*, **C-7,** March 1961, 5-11. This paper describes a digital computer program developed and used by the Canadian Department of Transport to determine nighttime sky wave signal interference to ground wave service. 3 refs.

1542 **Numerical solutions to the space-charge limited flow obtained by the separation of variables method.** P. T. Kirstein, L. Kantor and J. Szego, Stanford University, *PB 153503*, Aug. 1960, 80 p. The method of separation of variables was used by Langmuir to find a limited number of solutions to the equations of space-charge limited flows. In this report a whole new class of solutions to this problem by the method of separation of variables is discussed. These new solutions are characterised by the curvilinear nature of the electron trajectories, in contrast to Langmuir's, which were rectilinear. The mathematical method used permits the reduction of the partial differential equations describing the flow to a set of ordinary differential equations which are subsequently solved on a digital computer. A large number of different solutions which are tabulated in this report should find numerous applications in the field of electron beam generation. 11 refs.

ENGINEERING, CIVIL

1543 **Use of an analog computer for room air-conditioning calculations.** G. P. Mitalas, D. G. Stephenson and D. C. Baxter, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 175-192. This paper presents an analogue computer method for simulating the heat transfer phenomena occurring in an air-conditioned room and its environment; it is planned to use the method to compute air conditioning design data from statistically selected weather observations. Three related problems are discussed: (1) the calculation of the heating or cooling which is required to maintain an air-conditioned space at a specified air temperature when the ambient conditions outside the space vary in some manner; (2) the calculation of the air temperature which will exist in a building when the air conditioning plant capacity is insufficient to meet the maximum load required by (1); (3) the calculation of the temperature and temperature gradients of any points in the walls or roof of a building.

ENGINEERING, ELECTRICAL

1544 **Automatic load projection and substation planning by computer.** V. W. Ruskin, J. H. Drinnan and J. B. Claydon, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 193-210. This paper describes the application of a digital computer (IBM 650) by the B.C. Engineering Company Limited to the problems of forecasting the load at different points of an electricity supply system and planning new substation capacity or additions to existing substations. 4 refs.

1545 **Operating a power station with a computer.** A. J. Wakefield, *Control*, **4,** May and June 1961, 84-87 and 88-91. An account is given of the Panellit 609 process control computer system for control of a boiler-turbine, electric generating station. The centre of the 609 computer is a standard [National-Elliott] 803 general purpose digital computer. 1 ref.

ENGINEERING, MECHANICAL

1546 **Hydraulic servo control valves. Part 5. Analog simulation, pressure control, and high-temperature test facility design.** L. R. Axelrod, D. R. Johnson and W. L. Kinney, Cook Research Labs., *PB 154966*, Aug. 1958. 148 p. Analogue computer simulation of an electrohydraulic servo valve, investigation of pressure control valves and design of a high temperature test facility are discussed. Analytical relations are developed which describe the internal nonlinear operations of the valve. The equations are mechansied on an analogue computer and the results verified for static conditions.

INFORMATION RETRIEVAL

1547 **Mathematical model for a documentation system.** A. Kent, *Commun. ACM*, **4,** Feb. 1961, 114. Brief summary of work at the Center for Documentation and Communication Research, Western Reserve University, on theoretical and basic research investigations expected to lead to the formulation of a theory of documentation and of searching strategy. 5 refs.

MECHANICAL TRANSLATION

See :—
Elements, Ref. 1465.

MEDICAL

1548 **An analog computer model for the study of water and electrolyte flows in the extracellular and intracellular fluids.** W. H. Pace, *IRE Trans. Bio-medical Electronics*, **BME-8,** Jan. 1961, 29-33. An analogue computer model is presented which considers water flow as well as electrolyte flow in the two-compartment system consisting of the extracellular and intracellular fluids. The electrolyte flows are assumed to depend only on the electrolyte concentrations, and the water flow is assumed to depend on the electrolyte concentrations as well as the relative and absolute quantities of water. The intake rates are arbitrary, and the coefficients can be varied to simulate diseased conditions. 10 refs.

1549 **The Average Response Computer (ARC): a digital device for computing averages and amplitude and time histograms of electrophysiological response.** W. A. Clark, R. M. Brown, M. H. Goldstein, C. E. Molnar, D. F. O'Brien and H. E. Zieman, *IRE Trans. Bio-medical Electronics*, **BME-8,** Jan. 1961, 46-51. An account is given of the uses of the Average Response Computer (ARC), a special-purpose digital computer developed at Lincoln Laboratory, M.I.T. It has proved a valuable tool for measuring statistics of neuroelectric activity, particularly of evoked responses. The ARC has three principal modes of operation: response averaging, amplitude histogram compilation and time-interval histogram compilation. 8 refs.

1550 **Error estimation in transfer rates of plasma constituents.** B. H. Worsley, D. B. W. Reid and L. C. Lax, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 158-174. The use of radioisotopes as tracers to measure transfer rates of chemical constituents within living systems is briefly reviewed. The transfer rates are generally calculated from data obtained by considering the kinetics of distribution and turn-over of a given tracer-tagged constituent. The observed data of such experiments are fitted by means of summed exponential functions of the time which has elapsed following the addition of the tracer to the system. Most tracer methods for determining accumulation and turnover do not indicate the expected accuracy of their calculated results. This paper presents a new numerical technique for fitting data and for determining the error on a statistical basis for the derived transfer rates. The technique has been programmed for the University of Toronto digital computer [not identified in this paper, but believed to be an IBM 650—*Ed., C.A.*] and applied to clinical and laboratory data from human and animal subjects. 15 refs.

1551 **Computer techniques for the study of patterns in the electroencephalogram.** B. G. Farley, W. A. Clark et al, M.I.T., *PB 150607*, 6 Nov. 1957, 21 p. A process has been explored, using the Lincoln TX-O computer, for detecting patterns in the electroencephalogram and for recognising the characteristics of the EEG corresponding to individual subjects. Preliminary results indicate that a number of different subjects and states of the same subject can be distinguished with excellent probability. 7 refs.

MILITARY

1552 **ADAM (Attrition Damage Assessment Model).** B. A. Batchelder, *Commun. ACM,* **4,** Feb. 1961, 114. Brief summary of what is performed by ADAM, an IBM 704 program designed to do a Monte Carlo simulation of a one-sided air battle. 1 ref. See also Ref. 1553.

1553 **CAIN—a bombing mission planning tool.** B. A. Batchelder, *Commun. ACM,* **4,** March 1961, 139-140. Brief account of what is performed by CAIN, an IBM 704 program designed to adapt a statement of sortie requirements to a schedule of bomber and tanker sortie availabilities. Its output contains information which can be used directly in a run of ADAM (see Ref. 1552).

1554 **Analysis, design and development of high-flow helium pressure regulator. Volume 1.** W. Thompson and F. Nepo, Robertshaw-Fulton Controls Co., *PB 153617-1,* June 1960, 473 p. This report presents the analysis, design, development and test of a high-flow helium pressure regulator for a ballistic missile. It includes, *inter alia,* an account of extensive dynamic control analyses performed on the developmental regulator system using analogue computers. 4 refs. See also Ref. 1555.

1555 **Analysis, design and development of high-flow helium pressure regulator. Volume 2.** Robertshaw-Fulton Controls Co., *PB 153617-2,* June 1960, 333 p. This report presents the results of two analytical studies of transient pressure response for charging and venting volumes through nozzles in various combinations. The studies are printed as a separate volume to permit them to be used as a handbook or reference guide when similar studies are being made. See also Ref. 1554.

1556 **Three-dimensional flight table device No. 24-X-5.** M. Kanes, Bendix Aviation Corp., *PB 154806,* 1955, 9 p. The simulator was developed for use with a master computer for the purpose of simulating the flight of fast air-to-air missiles on a 1:1 time scale. The unit consists of a high-performance, servo-controlled gimbal system which follows command inputs from an analogue computer. Missile sections and components mounted on these gimbals are subjected to the torques, angular accelerations, and angular velocities which would be experienced in the flight being simulated. Instruments on the gimbals system monitor velocity and position, and compute Euler angle transformations.

1557 **3-D Trajectory simulation for aerodynamically controlled missiles.** T. J. Mueller, J. C. Walker et al, Douglas Aircraft Co. Inc., *PB 154970,* 8 Feb. 1960, 130 p. This report presents a mathematical formulation of a trajectory simulation program A06.0 along with explanations of the geometry and mechanics involved. Where the derivation of equations is not straightforward, derivations are presented. 4 refs.

See also :—
Business, Ref. 1533.
Simulation, Refs. 1575*b* and 1575*f*.
Miscellaneous, Ref. 1580.

NUCLEAR

1558 **Angie, a two dimensional, multigroup, neutron diffusion reactor code for IBM 704.** R. Stuart and S. Stone, University of California, *UCRL-5019,* 1957, 37 p.

1559 **APDAC-1, A PCTR data analysis code for the IBM 709.** J. R. Lilley, General Electric Co., *HW-63592,* Sept. 1960, 40 p.

1560 **BHT-M: An IBM digital computer program to calculate boiling heat transfer of steam generators.** H. Harden, Knolls Atomic Power Lab., *KAPL-M-NPA-15,* July 1960, 32 p.

1561 **BRIC—An IBM-704 two-dimensional nuclear-thermal depletion program with distributed void effects.** W. M. Jacobi et al. Westinghouse Electric Corp., *WAPD-TM-208,* Jan. 1961, 26 p.

1562 **CEPTR—An IBM-704 code to solve the P-3 approximation to the one-velocity transport equation in cylindrical geometry.** P. B. Daitch, et al. Combustion Engineering Inc., *TID-6940,* Sept. 1959, 41 p.

1563 **CURF1—a least-squares polynomial fitting program for the Philco-2000.** A. V. Pace, Westinghouse Electric Corp., *WAPD-TM-226,* Jan. 1961, 11 p.

1564 **Description of the IBM-704 code for the calculation of concentration transients in the HRT.** H. B. Piper and P. N. Haubenreich, Oak Ridge National Lab., *CF-60-10-8,* Oct. 1960, 14 p.

1565 **Development of a thermoelectric optimization code for the IBM-709.** T. S. Bustard and W. C. Lyon, Martin Co., *MND-P-2372,* July 1960, 142 p.

1566 **A fortran program for studying the core cooling capacity of a helium-air mixture.** R. C. Kaestner and R. J. Mulvihill, General Dynamics Corp., *GAMD-1224,* Feb. 1960, 59 p.

1567 **IBM 650 program for the calculation of capture-scattering and total cross-sections for S-, P- and D-wave neutrons.** C. Crafton and B. Roos, General Dynamics Corp., *GAMD-1251,* Feb. 1960, 20 p.

1568 **Input preparation for difussion-depletion programs on the Philco-2000 computer.** W. R. Cadwell and H. P. Henderson, Westinghouse Electric Corp., *WAPD-TM-238,* Jan. 1961, 14 p.

1569 **A program for the numerical integration of the Boltzmann transport equation, NIOBE.** S. Preiser, G. Rabinowitz and E. de Dufour, Nuclear Development Corp. of America, *PB 152587,* Dec. 1960, 67 p. A code (NIOBE) for numerically integrating the time-independent neutron or gamma ray Boltzmann transport equation has been written for the IBM 704. The code will calculate angular distributions, total fluxes and currents for neutrons (or photons) as a function of energy (or wave length) in a finite, multilayered, spherically symmetric configuration. 9 refs.

1570 **A program for the preparation of a nuclear data tape with fine energy detail (program FINDT, ANP NO-554).** J. R. Cooper and W. B. Henderson, General Electric Co., *TID-6647,* May 1960, 81 p.

1571 **Program SHAG—A monoenergetic multiregion slab cell correction calculation (GE-ANPD program no. 518).** F. D. Wenstrup, General Electric Co., *TID-6643,* June 1960, 89 p.

1572 **TCI—an auxiliary one dimensional transient conduction code for use with the art, spy and ter reactor design codes.** J. W. Millard, Knolls Atomic Power Lab., *KAPL-M-S 3G-RES-69,* Sept. 1959, 59 p.

1573 **WANDA-5—a one-dimensional neutron diffusion equation program for the Philco-2000 computer.** O. J. Marlowe and M. C. Suggs, Westinghouse Electric Corp., *WAPD-TM-241,* Nov. 1960, 31 p.

PHYSICS

1574 **Calculation of heat capacities and derived thermodynamic functions from thermal data with an IBM 704 digital computer.** B. H. Justice, University of Michigan, *TID-6206,* June 1960, 79 p.

SIMULATION

1575 **Simulation Council Newsletter.** J. McLeod (Ed.), *Instr. & Control Systems,* **34,** May 1961, 881-886, 888, 890, 891. Contains the first of a series of articles on analogue techniques and special circuits (see *a*), and an account of the papers given at the Midwestern Simulation Council meeting of 16 January 1961 (see *b* to *i*).

a. **Introducing limits to second-order systems.** T. C. Anderson, p. 881-883. The effects of various techniques for applying position and rate limits to a second order mechanical servo with rate and position feedback are discussed .

b. **Launching a small rocket from a helical rail.** J. E. Wilson, p. 883-884. Solution on the Goodyear A14 analogue computer of equations describing the launching loads and motion of a small flare rocket to be used for battlefield illumination.

c. **Analog techniques employed in a 'half-way-round-the-world' trajectory study.** R. O. Whitaker, p. 884-885. Outlines a systematic method for setting up the equations of a problem, such as a space vehicle trajectory, to facilitate programming of an analogue or digital computer.

d. **Simulation of steam generation in a heat exchanger.** P. J. Hermann, p. 885-886. Analogue technique for the simulation of steam generation in a large boiler or heat exchanger.

MILITARY

1552 **ADAM (Attrition Damage Assessment Model).** B. A. Batchelder, *Commun. ACM,* **4,** Feb. 1961, 114. Brief summary of what is performed by ADAM, an IBM 704 program designed to do a Monte Carlo simulation of a one-sided air battle. 1 ref. See also Ref. 1553.

1553 **CAIN—a bombing mission planning tool.** B. A. Batchelder, *Commun. ACM,* **4,** March 1961, 139-140. Brief account of what is performed by CAIN, an IBM 704 program designed to adapt a statement of sortie requirements to a schedule of bomber and tanker sortie availabilities. Its output contains information which can be used directly in a run of ADAM (see Ref. 1552).

1554 **Analysis, design and development of high-flow helium pressure regulator. Volume 1.** W. Thompson and F. Nepo, Robertshaw-Fulton Controls Co., *PB 153617-1,* June 1960, 473 p. This report presents the analysis, design, development and test of a high-flow helium pressure regulator for a ballistic missile. It includes, *inter alia,* an account of extensive dynamic control analyses performed on the developmental regulator system using analogue computers. 4 refs. See also Ref. 1555.

1555 **Analysis, design and development of high-flow helium pressure regulator. Volume 2.** Robertshaw-Fulton Controls Co., *PB 153617-2,* June 1960, 333 p. This report presents the results of two analytical studies of transient pressure response for charging and venting volumes through nozzles in various combinations. The studies are printed as a separate volume to permit them to be used as a handbook or reference guide when similar studies are being made. See also Ref. 1554.

1556 **Three-dimensional flight table device No. 24-X-5.** M. Kanes, Bendix Aviation Corp., *PB 154806,* 1955, 9 p. The simulator was developed for use with a master computer for the purpose of simulating the flight of fast air-to-air missiles on a 1:1 time scale. The unit consists of a high-performance, servo-controlled gimbal system which follows command inputs from an analogue computer. Missile sections and components mounted on these gimbals are subjected to the torques, angular accelerations, and angular velocities which would be experienced in the flight being simulated. Instruments on the gimbals system monitor velocity and position, and compute Euler angle transformations.

1557 **3-D Trajectory simulation for aerodynamically controlled missiles.** T. J. Mueller, J. C. Walker et al, Douglas Aircraft Co. Inc., *PB 154970,* 8 Feb. 1960, 130 p. This report presents a mathematical formulation of a trajectory simulation program A06.0 along with explanations of the geometry and mechanics involved. Where the derivation of equations is not straightforward, derivations are presented. 4 refs.

See also :—
Business, Ref. 1533.
Simulation, Refs. 1575*b* and 1575*f*.
Miscellaneous, Ref. 1580.

NUCLEAR

1558 **Angie, a two dimensional, multigroup, neutron diffusion reactor code for IBM 704.** R. Stuart and S. Stone, University of California, *UCRL-5019,* 1957, 37 p.

1559 **APDAC-1, A PCTR data analysis code for the IBM 709.** J. R. Lilley, General Electric Co., *HW-63592,* Sept. 1960, 40 p.

1560 **BHT-M: An IBM digital computer program to calculate boiling heat transfer of steam generators.** H. Harden, Knolls Atomic Power Lab., *KAPL-M-NPA-15,* July 1960, 32 p.

1561 **BRIC—An IBM-704 two-dimensional nuclear-thermal depletion program with distributed void effects.** W. M. Jacobi et al. Westinghouse Electric Corp., *WAPD-TM-208,* Jan. 1961, 26 p.

1562 **CEPTR—An IBM-704 code to solve the P-3 approximation to the one-velocity transport equation in cylindrical geometry.** P. B. Daitch, et al. Combustion Engineering Inc., *TID-6940,* Sept. 1959, 41 p.

1563 **CURF1—a least-squares polynomial fitting program for the Philco-2000.** A. V. Pace, Westinghouse Electric Corp., *WAPD-TM-226,* Jan. 1961, 11 p.

1564 **Description of the IBM-704 code for the calculation of concentration transients in the HRT.** H. B. Piper and P. N. Haubenreich, Oak Ridge National Lab., *CF-60-10-8,* Oct. 1960, 14 p.

1565 **Development of a thermoelectric optimization code for the IBM-709.** T. S. Bustard and W. C. Lyon, Martin Co., *MND-P-2372,* July 1960, 142 p.

1566 **A fortran program for studying the core cooling capacity of a helium-air mixture.** R. C. Kaestner and R. J. Mulvihill, General Dynamics Corp., *GAMD-1224,* Feb. 1960, 59 p.

1567 **IBM 650 program for the calculation of capture-scattering and total cross-sections for S-, P- and D-wave neutrons.** C. Crafton and B. Roos, General Dynamics Corp., *GAMD-1251,* Feb. 1960, 20 p.

1568 **Input preparation for difussion-depletion programs on the Philco-2000 computer.** W. R. Cadwell and H. P. Henderson, Westinghouse Electric Corp., *WAPD-TM-238,* Jan. 1961, 14 p.

1569 **A program for the numerical integration of the Boltzmann transport equation, NIOBE.** S. Preiser, G. Rabinowitz and E. de Dufour, Nuclear Development Corp. of America, *PB 152587,* Dec. 1960, 67 p. A code (NIOBE) for numerically integrating the time-independent neutron or gamma ray Boltzmann transport equation has been written for the IBM 704. The code will calculate angular distributions, total fluxes and currents for neutrons (or photons) as a function of energy (or wave length) in a finite, multilayered, spherically symmetric configuration. 9 refs.

1570 **A program for the preparation of a nuclear data tape with fine energy detail (program FINDT, ANP NO-554).** J. R. Cooper and W. B. Henderson, General Electric Co., *TID-6647,* May 1960, 81 p.

1571 **Program SHAG—A monoenergetic multiregion slab cell correction calculation (GE-ANPD program no. 518).** F. D. Wenstrup, General Electric Co., *TID-6643,* June 1960, 89 p.

1572 **TCI—an auxiliary one dimensional transient conduction code for use with the art, spy and ter reactor design codes.** J. W. Millard, Knolls Atomic Power Lab., *KAPL-M-S 3G-RES-69,* Sept. 1959, 59 p.

1573 **WANDA-5—a one-dimensional neutron diffusion equation program for the Philco-2000 computer.** O. J. Marlowe and M. C. Suggs, Westinghouse Electric Corp., *WAPD-TM-241,* Nov. 1960, 31 p.

PHYSICS

1574 **Calculation of heat capacities and derived thermodynamic functions from thermal data with an IBM 704 digital computer.** B. H. Justice, University of Michigan, *TID-6206,* June 1960, 79 p.

SIMULATION

1575 **Simulation Council Newsletter.** J. McLeod (Ed.), *Instr. & Control Systems,* **34,** May 1961, 881-886, 888, 890, 891. Contains the first of a series of articles on analogue techniques and special circuits (see *a*), and an account of the papers given at the Midwestern Simulation Council meeting of 16 January 1961 (see *b* to *i*).

a. **Introducing limits to second-order systems.** T. C. Anderson, p. 881-883. The effects of various techniques for applying position and rate limits to a second order mechanical servo with rate and position feedback are discussed .

b. **Launching a small rocket from a helical rail.** J. E. Wilson, p. 883-884. Solution on the Goodyear A14 analogue computer of equations describing the launching loads and motion of a small flare rocket to be used for battlefield illumination.

c. **Analog techniques employed in a 'half-way-round-the-world' trajectory study.** R. O. Whitaker, p. 884-885. Outlines a systematic method for setting up the equations of a problem, such as a space vehicle trajectory, to facilitate programming of an analogue or digital computer.

d. **Simulation of steam generation in a heat exchanger.** P. J. Hermann, p. 885-886. Analogue technique for the simulation of steam generation in a large boiler or heat exchanger.

. **A low-cost time delay.** R. J. King, p. 886. Describes a method of creating a time delay or transport lag, in which the input voltage is duplicated by manually tracking an oscillograph trace with a pointer which also drives a potentiometer.

. **Extended use of a general-purpose analog computer for missile control system development.** J. E. Westwick, p. 886, 888.

. **Pure time delay approximations.** J. Sansom, p. 888.

. **On-the-fly rescaling.** F. King, p. 888, 890. Circuit is described for effecting rescaling computer operation.

. **Design optimization by analog computer.** D. W. Sparks, p. 890-891. Determination of that combination of design constants which optimises a certain feature of the response of a system is well suited to the analogue computer, especially if the feature is the time of occurrence or magnitude of an event in the response.

RANSPORT

776 **The Electronic Reservations System for Trans-Canada Air nes.** L. E. Richardson, *Computing & Data Processing Soc. nada 2nd Conference Proc.*, 1960, 24-43. This paper describes new type Electronic Reservation System being constructed by rranti-Packard and which will be brought into operation by ans-Canada Air Lines during mid-1961. The system will con- t of a nation-wide network of input/output devices called ansactors which are connected by telephone circuits to a ntral computing facility. The main advantage claimed for the stem is that it is general purpose and other areas of applica- n are indicated. The Transactor is operated by the insertion a pencil-marked IBM-type card, the markings being electri- ly sensed, and the reply is punched on the card. Reliability is hieved by using two identical central computers which operate dependently but share a common memory system consisting magnetic drum and magnetic tape units. The computer speci- ation is binary notation, 25-bit word length, 4,096-word agnetic core store and add time of 56 microseconds.

777 **On finding minimum routes in a network with turn enalties.** T. Caldwell, *Commun. ACM*, **4,** Feb. 1961, 107-108. n some highway engineering work it is necessary to find a route etween two points in a city's street and freeway network such at a function of time and distance is minimised. Such a best oute can be found by a procedure due to E. F. Moore and the th best route by one due to W. Hoffman and R. Pavley. This aper shows that these procedures are still applicable when the unction to be minimised is redefined so that it depends on 'turn enalties' as well as time and distance. 2 refs.

578 **Highlights of data processing at the C.N.R.** W. R. Corner, *'omputing & Data Processing Soc. Canada 2nd Conference roc.*, 1960, 265-275. This paper is concerned with integrated ata processing using two IBM 650 computers (an IBM 7070 eing on order) in the Canadian National Railways. After an ccount of the administrative organisation for integrated data rocessing, brief descriptions are given of applications to in- entory control of materials and stores, payroll, way-billing, ard to yard mechanisation, freight car tracing, freight car ccounting, operating statistics, revenue accounting and traffic tatistics.

579 **Digital computer program. Drawbar pull prediction vheeled vehicles.** H. C. Mottin, Ordnance Tank-Automotive Command, Center Line, Michigan, *PB 153562*, 15 Nov. 1960, 8 p. A digital computer program is presented for determining he drawbar pull or gradeability of a wheeled vehicle with either standard or automatic transmission. 1 ref.

See also :—
Business, Ref. 1526.

MISCELLANEOUS

1580 **Information system controls rocket engine reliability.** G. E. Olson, *Control Engng.*, **8,** May 1961, 134-135. A brief account is given of an information recording and processing system which provides complete reliability data on every component in every rocket engine manufactured by Rocketdyne. The system, which is called RAPID (Rocketdyne Automatic Processing of Integrated Data), employs an IBM 7090 which stores and processes detailed information on all the failures occurring on all Rocketdyne products, from a torquing problem with a bolt on an acceptance test firing to a turbopump malfunction that happens in a count down on the missile launch pad.

1581 **Questionnaire analysis by UNIVAC.** N. Bush, *Data Processing (Detroit)*, **3,** May 1961, 24-25. This article outlines procedures and programs used at the University of North Carolina Computation Center for analysing on a UNIVAC 1105, data obtained by means of questionnaires.

1582 **Some computer applications to ship design calculations.** A. A. Titinero, *Computing & Data Processing Soc. Canada 2nd Conference Proc.*, 1960, 138-157. A brief explanation is given of the hydrostatic calculations used by shipbuilders and ship operators to determine the behaviour of the vessel in the water and which give information used to determine the trim, stability and displacement of the vessel. The programming of an IBM 650 by Davie Shipbuilding Limited to carry out the hydrostatic calculations is then described. Finally, other shipbuilding applications of digital computers are mentioned.

1583 **Sound learning: an application of a computer to automated teaching.** J. A. Swets, *Commun. ACM*, **4,** March 1961, 139. Brief summary of research having the aim to determine experimentally whether the techniques of automated teaching will significantly facilitate learning to identify non-verbal sounds, using a PDP-1 computer for simulation of teaching machines.

1584 **Statistical programs at the University of North Carolina.** N. Bush, *Commun. ACM*, **4,** Feb. 1961, 108-109. Brief details are given of three statistical programs developed at the University of North Carolina for the UNIVAC 1105 and written in the Remington Rand UNICODE language. The programs are: General contingency table analysis for questionnaire data (tabulates two-way tables from coded questionnaire data); Analysis of variance (with complete generality in computing sums of squares for an *F*-test for almost any type of analysis of variance); Multiple regression and correlation.

1585 **Computing effective powers and associated coefficients from ship model resistance tests.** P. G. Morel, National Research Labs., Canada, *PB 154057*, Sept. 1960, 76 p. A detailed description is given of a program for analysing the results of a resistance test of a ship model using the Bendix G-15D. The flexibility of entering the input data allows output data for any size of model or ship in salt or fresh water at any temperature, and also allows for different skin roughnesses and for the introduction of a form factor. Besides absolute values for resistance, power and speed, various coefficients are given. The possibility of calculating the tow-rope force correction for a self-propulsion test is also incorporated.

See also :—
Simulation, Ref. 1575*i*.

BOOKS

1586 **The Computing and Data Processing Society of Canada 2nd Conference: June 6, 7, 1960—Proceedings.** A. P. Macfarlane (Ed.), University of Toronto Press, Oxford University Press, 1960, vi+365 p., $5.00, £2. 0. 0. Contains the papers presented at the second conference of the Computing and Data Processing Society of Canada, 6-7 June 1960. The papers are abstracted in Refs. 1378, 1381, 1383, 1385, 1386, 1388, 1404, 1405, 1414, 1419, 1424, 1429, 1445, 1493, 1496, 1497, 1504, 1515, 1523, 1525, 1526, 1527, 1537, 1543, 1544, 1550, 1576, 1578, and 1582.

1587 **Some commercial autocodes: a comparative study.** E. L. Willey, A. d'Agapeyeff, M. Tribe, B. J. Gibbens and M. Clark, Academic Press, June 1961, vii+53 p., 15s. 0d. This volume is the first of the A.P.I.C. Studies in Data Processing published for the Automatic Programming Information Centre, Brighton College of Technology by the Academic Press. It provides a comparative study of the following languages: FLOWMATIC (UNIVAC I and II); IBM COMMERCIAL TRANSLATOR (IBM 705, 7080, 709, 7090, 7070); COBOL; FACT (Honeywell 800); CODEL (I.C.T.); ELLIOTT'S (Elliott 803); NEBULA (ORION); and SEAL (STANTEC Computing System). The study is limited to the following features (details being presented mainly in tabulated form): arithmetic in regard to formulae, addition and subtraction, multiplication, division, rounding, and overflow; data movement and level structure; logic in regard to conditional sentences, naming procedures and data in procedure division, subroutines and loops, branching and switching, and function definition. The use of conditional sentences is illustrated by an example taken from a payroll application and translated into each of the languages. 29 refs.